[seal]

(19) **RU** (11) **2094121** (31) **C1**

(51) **6 B03B1/00**

RUSSIAN AGENCY

FOR PATENTS AND TRADEMARKS

(12) **INVENTION SPECIFICATION**

Pertaining to a Patent of the Russian Federation

(14) Publication date: **10/27/1997**

(21) Registration no. of application: **95120308/25**

(22) Filing date: **11/29/1995**

(46) Date of publication of claims: **10/27/1997**

(56) Analogs of the invention: **Sidenko P.M. Size Reduction in the Chemical Industry Moscow: Khimiya Publishers, 1988, page 251. Rodionov A. I., Klushin V. N., Torocheshnikov N. S. Environmental Protection Engineering - Moscow: Khimiya Publishers, 1989, page 234.**

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(54) METHOD FOR SEPARATION OF SOLID PHASES

The invention pertains to separation of solid materials by flotation and their purification from impurities, and can be applied in the chemical, petrochemical, microbiological and a number of other branches of industry. The technical results attainable when the proposed method of separation of solid phases is used consists of intensification of flotation and an increase in the quality of purification of contaminated surfaces by overcoming adhesion forces combined with rational organization of the separation process and optimization of the geometric characteristics of the cavitator. The method of separation of solid phases, consisting of a main material 1 and an impurity component 2, immersed into a liquid medium 3, includes autonomous supply of liquid through a connector 4, equipped with a nozzle-cavitator 5 of variable equivalent diameter, and a gas, by means of a connector 6. Supply of liquid is carried out at the interface of the solid phase, in which case the minimal equivalent diameter of the nozzle-cavitator 5 is smaller than the projection of the distance from the external edge of the nozzle-cavitator 5 to the outside surface of the solid phase, measured along its longitudinal axis intersecting the longitudinal axis of the gas feed connector 6 at its point of contact with the solid phase. 3 figures.

The invention pertains to separation of solid materials by flotation and their purification from impurities and can be used in the chemical, petrochemical, microbiological and a number of other branches of industry.

Methods are known for separating solid phases into fractions by screening, and also under the influence of gravitational-inertial and gravitation-centrifugal forces [1].

Among the general shortcomings of these methods, one must include the impossibility of using them when the materials being separated have significant adhesion capacity, and also when surfaces of large dimensions are being treated, which are not subject to mechanical disruption.

The method closest in technical essence and attainable results of the proposed technical solution is a flotation method for separation of solid materials immersed into a liquid medium, including separate supply of liquid and gas, by means of connectors into the liquid medium [2].

A shortcoming of this method for separation of solid phases is the low efficiency of the process and the long time for its performance in those cases when adhesion of the components being separated is high and consequently the flotation scheme hardly functions at all.

The technical result attainable using the proposed method of separation of solid phases consists of intensifying the flotation process and increasing the quality of purification of contaminated surfaces by overcoming the adhesion forces, combined with rational organization of the separation process and optimization of the geometric characteristics of the cavitator.

This technical result is achieved in that, combined with the method for separation of solid phases, immersed into a liquid medium, including autonomous feed of liquid and gas by means of connectors and liquid medium, according to the invention, the liquid feed connectors are equipped with a nozzle-cavitator of variable equivalent diameter and supply of liquid is carried out at the interface of the solid phase, in which case the minimal equivalent diameter of the nozzle cavitator is less than a projection of the distance from the external edge of the nozzle-cavitator to the outside surface of the solid phase, measured along its longitudinal axis, intersecting the longitudinal axis of the gas connector at its point of contact with the solid phase.

Equipping the liquid feed connector with a nozzle-cavitator of variable equivalent diameter ensures active erosion disruption of the impurity component with subsequent active transport from the zone of contact by an air stream fed by means of a corresponding connector. At the same time, fulfillment of the condition that governs the ratio of minimal equivalent diameter of the nozzle-cavitator to a projection of the distance from the external edge of the nozzle-cavitator to the outside surface of the solid phase, measured along its longitudinal axis, ensures the possibility of running the process in the most intense modes, which is necessary during significant adhesion capacity of the components without disrupting the operating device, combined with rational distribution of energy of the cavitating stream.

Fig. 1 shows an illustration of an example of this method of separation of the main material 1 and the impurity component 2 immersed into a liquid medium 3, using a liquid feed connector 4 equipped with a nozzle-cavitator 5 of variable free cross section, oriented at angle β to the surface of the solid phase, varying in the range from 0 to 90°, and also a gas feed connector 6; Fig. 2 and 3 show some of the possible variants of nozzle-cavitator 5 in the form of a hollow element or equipped with an additional element 7 installed with a gap to the inside wall of the

nozzle-cavitator 5. In the case in which the nozzle-cavitator 5 is made hollow, the minimal equivalent diameter d^E_{min} is equal to its minimal inside diameter d_{min}, and in the presence of additional element 7, the minimal equivalent diameter is determined with allowance for the minimal cross section of nozzle-cavitator 5.

The arrows in Fig. 2 and 3 show the direction of motion of the liquid.

In all variants of the nozzle-cavitator, the minimal equivalent diameter d^E_{min} is less than the projection L_0 of the distance L from the external edge of the nozzle-cavitator 5 to the outside surface of the solid phase 2, measured along its longitudinal axis intersecting the longitudinal axis of gas feed connector 6 at its point of contact with the solid phase.

Thus, $d^E_{min} < L_0 = L \cos\alpha$, where $\alpha = 90 - \beta$.

Implementation of this method of separation of solid phases is accomplished as follows.

Liquid under pressure is fed into connector 4 and enters nozzle-cavitator 5, where a consecutive increase in transverse pulsations of stream velocity occur and its acceleration with subsequent formation of cavitation nuclei and gas bubbles displaced into a space bounded by the external edge of nozzle-cavitator 5 and the surface 2 of the impurity component immersed into liquid medium 3. Collapse of the bubble that occurs causes erosion disruption of solid phase 2, whose particles are actively removed by means of connector 6, whose axis intersects the axis of nozzle-cavitator 5 at its point of contact with the solid phase 2. The components of the impurity component 2 with high density settle, and the comparatively light particles, as a result of flotation, wind up in the foam layer, which is removed by force or by gravity.

CLAIM

Method for separation of solid phases immersed into a liquid medium, including autonomous feed of liquid and gas by means of connectors into a liquid medium, characterized by the fact that the liquid feed connector is equipped with a nozzle-cavitator of variable equivalent diameter and supply of liquid is carried out in the direction of the surface of the solid phase, in which case the minimal equivalent diameter of the nozzle-cavitator is less than the projection of the distance from the external edge of the nozzle-cavitator to the outside surface of the solid phase, measured along its longitudinal axis intersecting the longitudinal axis of the gas feed connector at its point of contact with the solid phase.